August 1971

Brief 71-10295

NASA TECH BRIEF

Manned Spacecraft Center

Determination of Radiation Interchange Factors

The problem:

To devise a method for the analytical and empirical determination of radiation interchange factors.

The solution:

An analytical model, a method of solution which is compatible with digital computer analysis, and a generalized computer program to carry out the computations.

How it's done:

The program computes thermal and solar radiation interchange factors among surfaces having any combination of the following properties:

1. Diffuse emittance and reflectance,
2. Diffuse emittance and specular reflectance,
3. Diffuse emittance and components of diffuse and specular reflectance, and
4. Directional emittance and bidirectional reflectances.

Enclosures which contain only the first three types of surfaces may be simulated by a maximum of 1500 surfaces. Fully bidirectional enclosures are limited to 38 surfaces or less. The maximum number of surfaces in a mixed enclosure is governed by

$$NM + M - N$$

where M = total number of surfaces, and N = number of bidirectional surfaces.

In addition to the standard node-to-node matrix formulation, a mean-to-local approximation is available as a user's option. The method utilizes average property values for groups of surfaces. This can result in significant reductions in the size of the matrices and in the time required to invert them.

The program input includes surface properties and geometrical data defining the shape, size, and location of each surface in the enclosure. The program printout includes input data, form factors, exchange factors, the transfer matrix and its inverse, nodal areas, and interchange factors.

Notes:

1. This program is written in FORTRAN V for use on the UNIVAC-1108 computer.
2. Requests for further information may be directed to:

   COSMIC
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: B71-10295

Patent status:

No patent action is contemplated by NASA.

Source: R. P. Bobco, F. L. Egendorf, and R. J. McGrath of Hughes Aircraft Co. under contract to Manned Spacecraft Center (MSC-13475)

Category 09